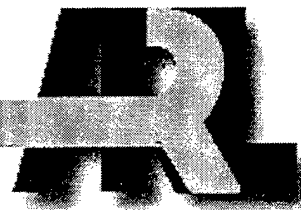


ARMY RESEARCH LABORATORY



Skill Level 10 Operations and Unit Maintenance
Skills: An Examination of Tactical Unmanned
Vehicle (TUV) Soldier-Marine Capabilities

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Abstract

An analysis was performed to identify specific skills required to successfully perform operations and unit maintenance tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a skill level of 10 have those skills. This analysis was performed by the Human Research and Engineering Directorate of the U.S. Army Research Laboratory at the behest of the Program Manager Unmanned Ground Vehicles/Systems. Military occupational specialties examined included U.S. Army infantryman (11B), cavalry scout (19D), and the Marine Corps rifleman (0300). System-required operations and unit maintenance functions and tasks were identified. Soldier-marine operations and unit maintenance skills were compared to these tasks. Results of the analysis show that of 209 operations skills required by the TUV system, 82 were mismatched because of a higher skills requirement, untrained system-specific skills, or a combination of both. Additionally, all 25 unit maintenance tasks were identified as requiring system-specific training.

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SKILL LEVEL 10 OPERATIONS AND MAINTENANCE SKILLS: AN EXAMINATION OF TACTICAL UNMANNED VEHICLE (TUV) SOLDIER-MARINE CAPABILITIES

PURPOSE

The purpose of this document is to identify specific skills required to successfully perform operations and maintenance tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a skill level of 10 have those skills. The Program Manager, Unmanned Ground Vehicles/Systems (PMUGV/S) solicited the Human Research and Engineering Directorate (HRED) of the U.S. Army Research Laboratory (ARL) to assist in performing this task.

The desired TUV system will be built to enable operation and unit maintenance, in its entirety, by a skill level 10 U.S. Army soldier or a U.S. marine (soldiers-marines). Specifically, the military occupational specialties (MOSs) for these soldiers-marines will be infantryman (11B), cavalry scout (19D), and the Marine Corps rifleman (0300). The source of this issue is the PMUGV/S Joint Project Office (JPO) TUV outstanding issues database:

Issue No. 1.143: What tasks are required to perform all operations and unit maintenance for TUV?

BACKGROUND

The TUV will be the first fielded unmanned system designed for the removal of soldiers-marines from hostile environments. To date, no prior work has addressed the skills required by soldiers-marines to perform teleoperations tasks. The personnel requirement of this future system is that it be readily usable by all soldier-marine skill levels within the MOS fields identified (USMC 0300, U.S. Army 19D, and U.S. Army 11B). The ability to remotely control (teleoperate) this system will depend mainly upon human factors interface design characteristics. Past unmanned ground system failures have been traced to either inefficient sensor design or to poorly designed control display layout. Some anecdotal evidence of this comes from two sources: the Office of the Secretary of Defense (OSD) demonstration (DEMO) I and the surrogate teleoperated vehicle (STV) operational test. During DEMO I, a demonstration of teleoperated systems technology, it was noted that to maintain proper vehicle control, vehicle operators seldom exceeded 5 mph on secondary roads. The STV operational test had two operators working simultaneously, one for vehicle operation and one for navigation. The STV system had little to no usable situational awareness information, and the operators often could not determine where the vehicle

was. (The fiber-optic connection to the vehicle was followed to locate the vehicle.) In addition, the STV tipped over more than once, which was attributed to lack of vehicle orientation cues (pitch and roll). The important issue here is to present navigational information in a cohesive, efficient, and useful manner. Mission success is a combination of well-trained soldiers-marines using well-planned equipment.

Before continuing, some explanation of both the improved performance research integration tool (IMPRINT) and the SARGE (not an acronym) mission planner is required to understand this document. IMPRINT is described because of its utility in developing function and task networks, which were needed to establish the tasks required of the operator. The SARGE mission planner is described because of its future incorporation into the TUV system.

IMPRINT

IMPRINT is a Windows[™]-based software application for conducting front end analyses (FEAs) in support of materiel acquisition programs or upgrades. IMPRINT is a multi-dimensioned analysis tool that can be used to conduct a variety of different types of studies. It can be used to assess human-system performance during a variety of conditions (e.g., with and without mission-oriented protective posture [MOPP]). Physical and cognitive workload for the system's crew can be estimated. IMPRINT can also be used to assess maintenance policies and procedures (e.g., does adding another shift increase operational availability?). Another use is to assess manpower, personnel, and training requirements for weapon system alternatives being considered.

IMPRINT provides an integrated environment to store and retrieve a variety of data sets that are pertinent to a system. For example, task, personnel, equipment, and force structure data can be combined and integrated using IMPRINT. Additionally, IMPRINT has extensive data libraries and reference data sets that can be pulled directly into an analysis, avoiding data entry and saving user time. Users can also move data easily between IMPRINT and other Windows[™]-based applications. This is the case for this analysis; a complex function and task network was developed in IMPRINT for the purpose of understanding work functions and task breakdown structures. Task information developed in IMPRINT was moved into the Excel[™] spreadsheet environment for this analysis.

SARGE

SARGE is a small all-terrain vehicle that has been fitted with teleoperation-capable hardware and software. The mission-planning capability of the TUV will be adapted from the SARGE. SARGE is a mobile platform that is controlled by an operator at an operator control unit (OCU). This OCU has four basic functions: (a) driving, (b) reconnaissance, (c) navigation, and (d) mission planning. The navigational display lets the operator know where the mobile base unit (MBU) or teleoperated vehicle is in relation to the OCU and friendly or enemy units. The mission-planning display lets the operator plan OCU position, final MBU position, and waypoint placement. Mission planning also includes the use of radio frequency (RF) and line-of-sight (LOS) analysis to plan the optimum MBU route. The SARGE mission planner and navigational displays reside in a separate control-display configuration. This interface exists on a small laptop computer that uses a map display, pull-down menus, and a mouse control in a common personal computer operating system. The SARGE mission planner will be adapted to the future TUV system.

METHODOLOGY

A summary of the methodology used for this analysis is a comparison of tasks required to operate and maintain the TUV and the skills that soldiers-marines have at the skill 10 level. Data sources were sought that described the basic and MOS skills that soldiers-marines have. The appropriate skills were identified in those sources. The tasks from the overall TUV task list were reviewed to identify those tasks relating to operations and unit maintenance. Finally, those tasks were compared to the skills of the soldiers-marines.

Data Sources

Data sources used for this effort are listed in the References section of this report.

Soldier-Marine Operations and Unit Maintenance Skills Identified

Tasks relating to operations and unit maintenance were identified by the author of this report. Soldier-marine common tasks and basic MOS skill requirements are listed in Appendix A.

Tasks Identified

Operations and unit maintenance functions and tasks are listed in Appendix B, Columns 1 through 4. ARL developed a detailed TUV operations task network in IMPRINT, based on

functions of the TUV system. The functions of the TUV system were adapted from a systems engineering functional flow block diagram developed at PMUGV/S. The unit maintenance task list was adapted from a draft reliability, availability and maintainability (RAM) model document obtained from PMUGV/S.

The IMPRINT model was assembled for assessing soldier-marine workload under various TUV operations and maintenance scenarios. The function and task networks for TUV operations and maintenance were developed from collaboration between ARL and PMUGV/S. The task lists have been “cut and pasted” from the IMPRINT task network.

The original task list also includes dummy task nodes and “yes-no” decision points for numerous cognitive choices in the IMPRINT task networks. They are ignored and denoted with an “n/a” symbol. Operations tasks were identified from interviews conducted by PMUGV/S support personnel with Armored Battalion Scouts (19D), of the 2-69th Armored Battalion at Fort Benning, Georgia. The content of the interviews concerned the development of a TUV mission plan, based on an operations order (OpOrder) from a battalion-level commander. The mission would include the planning of several legs of a route for the TUV MBU (as listed in task lists), and a vehicle-mounted OCU.

Operations tasks for driving were formulated by ARL and subsequently approved by PMUGV/S as a result of an ARL-PMUGV/S effort.

Soldier-Marine Operation and Unit Maintenance Skills Cross-Walked Onto Operation and Unit Maintenance Tasks

The tasks affected in the overall function and task list were identified in Columns 11 and 12 of Appendix B. Column 13 describes in brief format the nature of the conflict with skill level 10 capabilities. The decision of whether skills were compatible with the tasks was made by the author, using the opinion of a subject matter expert (SME), a Major (Inf) at PMUGV/S who has several years of experience in the area of unmanned systems.

ANALYSIS RESULTS

Table 1 is a detailed listing of the nature of conflicting tasks identified for TUV operations and unit maintenance.

All unit-level maintenance tasks have been identified as requiring skills that are specific to the TUV (see Table 2). It is possible that some repair-and-replace tasks will be similar to others

that soldiers-marines can already perform on other vehicles; however, this is not presently known. Therefore, all unit-level maintenance tasks are to be considered untrained in the user population at this time.

Table 1
Conflicting Tasks and Skills Identified

Task identified	Soldier-marine MOS affected
7.4.3.1.1 <i>Assess Named Area of Interest (NAI) from Operations Order (Op Order)</i>	ALL
Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform this task. We recommend that the assessment of the NAI from the OpOrder be performed by a skill level 20 soldier-marine or that this task be trained to skill level 10 soldiers-marines.	
7.4.3.1.2 <i>Place MBU Icon in Final Reconnaissance, Surveillance, Target Acquisition (RSTA) Point</i>	ALL
7.4.3.1.3 <i>Does MBU LOS and Range Fan Cover the NAI?</i>	ALL
7.4.3.1.6 <i>Reposition MBU to Modify the LOS and Range Fan</i>	ALL
These tasks are untrained tasks which are unique to the SARGE mission planner and are skills unique to the 19D Cavalry Scout at the 30 skill level. We recommend that these tasks either be performed by skill level 30 19D Cavalry Scouts or that soldiers-marines be trained specifically in the use of the SARGE mission planner.	
7.4.3.2.1 <i>Is Fiber-optic a Mission Requirement?</i>	ALL
Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform this task. We recommend that the assessment of the fiber-optic use from the Op Order be performed by a skill level 20 soldier-marine or that this task be trained to skill level 10 soldiers-marines.	
7.4.3.2.4 <i>Place OCU Icon on OCU Map Display</i>	ALL
The task identified is a specific untrained task which is unique to the SARGE mission planner. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner.	
7.4.3.2.5 <i>Concealment of OCU OK for LOS RF?</i>	ALL
7.4.3.2.6 <i>Is Distance to MBU OK for LOS RF?</i>	ALL
7.4.3.2.7 <i>Is Terrain OK for LOS RF?</i>	ALL
7.4.3.2.8 <i>Is Enemy Situation OK for LOS RF?</i>	ALL
7.4.3.2.9 <i>Is Friendly Situation OK for LOS RF?</i>	ALL
7.4.3.2.14 <i>Is Concealment OK for fiber-optic?</i>	ALL
7.4.3.2.15 <i>Is Distance to MBU OK for fiber-optic?</i>	ALL
7.4.3.2.16 <i>Is Terrain OK for fiber-optic?</i>	ALL
7.4.3.2.17 <i>Is Enemy Situation OK for fiber-optic?</i>	ALL
7.4.3.2.18 <i>Is Friendly Situation OK for fiber-optic?</i>	ALL
Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform this task. We recommend that the assessment of the concealment, distance to MBU from OCU, terrain, enemy and friendly situations for both LOS RF and fiber-optic operation from the Op Order be performed by a skill level 20 soldier-marine or that this task be trained to skill level 10 soldiers-marines.	
Additionally, the tasks identified are specific untrained tasks which are unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.	

Table 1 (continued)

7.4.3.3.1 <i>Step MBU back from Present Position</i>	ALL
7.4.3.3.2 <i>Have LOS of Previous MBU Location?</i>	ALL
7.4.3.3.9 <i>Step OCU Back Behind MBU</i>	ALL

The tasks identified are specific untrained tasks which are unique to the SARGE mission planner. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner.

7.4.3.4.1 <i>Coordinate MBU Movement Forward One Leg</i>	ALL
7.4.3.4.2 <i>Coordinate OCU Movement to MBU</i>	ALL

The tasks identified are specific untrained tasks which are unique to the SARGE mission planner. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner.

7.4.3.5.1 <i>Establish Secondary Support Mission to Other Sections</i>	ALL
7.4.3.5.2 <i>Create Alternate Route Plan for Alternate Mission</i>	ALL

Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform these tasks. We recommend that the assessment of the mission, enemy, troops, and time available from the Op Order be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines. Additionally, the task identified is a specific untrained task which is unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.

7.4.3.6.2 <i>Evaluate Mission</i>	ALL
7.4.3.6.3 <i>Evaluate Enemy</i>	ALL
7.4.3.6.4 <i>Evaluate Troops</i>	ALL
7.4.3.6.5 <i>Evaluate Time Available</i>	ALL

Interpreting an Op Order is a 20 level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform these tasks. We recommend that the assessment of the mission, enemy, troops, and time available from the Op Order be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines.

7.4.3.6.11 <i>Evaluate Foliage (LOS & RF Distances per Leg)</i>	ALL
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Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform these tasks. We recommend that the assessment of the evaluation of foliage (which affects LOS and RF distances per travel leg) be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines. Additionally, the task identified is a specific untrained task which is unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.

7.4.3.6.14 <i>Estimate Average Speed Over Route</i>	ALL
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The task identified is a specific untrained task which is unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.

7.4.3.7.1 <i>Collect Coordinated Mission Plans from Sections</i>	ALL
7.4.3.7.2 <i>Send Platoon Mission Plan to Battalion</i>	ALL

Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 11B Infantryman and 19D Cavalry Scout 20 skill level should be able to perform these tasks. We recommend that the assessment of the mission, enemy, troops, and time available from the Op Order be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines.

Table 1 (continued)

7.4.7.13 <i>Put Unit on Mission Package</i>	ALL
7.4.6.17 <i>Remove Unit</i>	ALL

This task is identified as one that can be performed by all skill level 10 soldiers-marines; however, for the TUV system, training will be required for this task to be performed in a faster, more efficient manner. We recommend that all operators be trained specifically in the use of the TUV mission package assembly and disassembly.

7.4.7.1 <i>Does the Mission Package Require...</i>	ALL
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Interpreting an Op Order is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 11B Infantryman and 19D Cavalry Scout 20 skill level should be able to perform these tasks. We recommend that the decision to add or delete specific sensors to and from the mission package, based on the interpretation of the Op Order, be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines.

7.5.1 <i>Move (Function)</i>	
7.5.1.1.1 <i>Rig for Airdrop</i>	ALL
7.5.1.1.2 <i>LVAD Capable</i>	ALL
7.5.1.1.3 <i>Pack Energy Dissipating material for LVAD</i>	ALL
7.5.1.1.4 <i>Provide Secure Points for LVAD Platform</i>	ALL
7.5.1.1.5 <i>Allow malfunction Condition Drops</i>	ALL
7.5.1.1.6 <i>Load on Transport</i>	ALL
7.5.1.1.7 <i>Transport to Drop Point</i>	ALL
7.5.1.1.8 <i>Execute Air Drop</i>	ALL
7.5.1.1.9 <i>De-Rig/Assemble</i>	ALL
7.5.1.2.1 <i>Rig for Air Assault</i>	ALL
7.5.1.2.2 <i>Load on Transport</i>	ALL
7.5.1.2.3 <i>Transport</i>	ALL
7.5.1.2.4 <i>Air Insertion</i>	ALL
7.5.1.2.5 <i>De-Rig/Assemble</i>	ALL
7.5.1.3.1 <i>Rig</i>	ALL
7.5.1.3.2 <i>Load on Transport</i>	ALL
7.5.1.3.3 <i>Transport</i>	ALL
7.5.1.3.4 <i>Off-Load</i>	ALL
7.5.1.3.5 <i>De-Rig/Assemble</i>	ALL
7.5.1.4.1 <i>Rig (amphibious)</i>	ALL
7.5.1.4.2 <i>Load</i>	ALL
7.5.1.4.3 <i>Load on Amphibious Ship</i>	ALL
7.5.1.4.4 <i>Load on Amphibious landing Craft</i>	ALL
7.5.1.4.5 <i>Transport</i>	ALL
7.5.1.4.6 <i>Off-Load (amphibious)</i>	ALL
7.5.1.4.7 <i>De-Rig/Assemble</i>	ALL

The identified tasks are those that can be performed by all skill level 10 soldiers-marines; however, these tasks are specific to TUV operations. We recommend that all operators be trained specifically in the use of the TUV movement for various types required.

7.5.3.1.4 <i>Navigation Position Correct? (UTM/GPS/Waypoint)</i>	ALL
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This task is identified as one that can be performed by all skill level 10 soldiers-marines; however, for the TUV system, training will be required for this task to be performed in a faster, more efficient manner. We recommend that all operators be trained specifically in the use of the TUV navigational aids, specifically, the heads-up display in the driving view that represents vehicle heading and sensor heading in degrees, the integrated vehicle and sensor icon, and the navigational map screen with the additional integrated vehicle and sensor icon.

Table 1 (continued)

7.5.3.4.6	<i>Classify Contaminant</i>	11B
7.5.3.4.7	<i>Nuclear Contaminant</i>	11B
7.5.3.4.8	<i>Biological Contaminant</i>	11B
7.5.3.4.9	<i>Chemical Contaminant</i>	11B
7.5.3.4.10	<i>Report NBC Information</i>	11B, marine CPL

These tasks are not currently trained for all skill levels for MOS 11B and for Private, USMC. It is recommended that the classification of contaminants as identified by remote NBC sensors be trained to all skill 10 11B and 0300 marine riflemen.

7.5.4.1.4	<i>Repair as Needed</i>	ALL
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All unit-level maintenance tasks have been identified as requiring skills that are specific to the TUV. It is possible that some repair-and-replace tasks may be similar to other repair-and-replace tasks that soldiers can perform on other vehicles; however, this is not presently known. Therefore, all unit-level maintenance tasks are to be considered untrained in the user population at this time.

7.5.4.1.7	<i>Charge MBU Batteries</i>	ALL
7.5.4.1.8	<i>Charge OCU Batteries</i>	ALL

The identified tasks can be performed by all skill level 10 soldiers-marines; however, the tasks are specific to TUV operations. We recommend that all operators be trained specifically in the charging of TUV MBU and OCU batteries.

7.5.4.2.1	<i>Stow OCU for Transport</i>	ALL
7.5.4.3.1	<i>Rig MBU for Travel/Transport</i>	ALL

The identified tasks can be performed by all skill level 10 soldiers-marines; however, the tasks are specific to TUV operations. We recommend that all operators be trained specifically in TUV OCU and MBU stowage and rigging for movement of various types required.

CONCLUSIONS

Many tasks are projected to be difficult or impossible for the skill level 10 soldiers-marines of the identified MOSs. There are three reasons: (a) the skill requirement for that generic task was higher than skill level 10, (b) the tasks identified are peculiar to a specific type of system operation (SARGE mission planner), or (c) a combination of reasons (a) and (b).

Of the total list of 234 applicable tasks, there were 107 task and skill incompatibilities. Of all operations tasks, 10 skill level, 5 MOS-related tasks, and 42 system-specific task and skill mismatches were identified. All 25 unit maintenance tasks (repair and replace) were identified as task and skill mismatches. Table 3 provides these data in tabular form.

Table 2

Conflicting Unit Maintenance Tasks and Skills Identified

Task identified	Subsystem	Component	Soldier-marine MOS affected
Remove and replace	RCMMS (teleoperation)	Platform (teleoperation)	ALL
		System power	ALL
		MBU actuation package	ALL
		Control electronics	ALL
		Driving sensor	ALL
	RCMMS (recharge)	Platform (recharge)	ALL
		System power	ALL
	Chemical/biological detection	Chemical detection	ALL
		Biological detection	ALL
	Laser range finder	Laser range finder	ALL
	Reconnaissance, surveillance, & target acquisition	Targeting sensor	ALL
		Pan/tilt	ALL
		Control electronics	ALL
		Acoustic detection	ALL
		Motion sensors	ALL
	Operator control unit	Operator control unit	ALL
	Data link	Data link	ALL
	Video link	Video transmission	ALL
		Video link radios	ALL
	Communications	Communications equipment	ALL
	Navigation package	Navigation package	ALL
	Microphone	Microphone	ALL
	OCU support vehicle (movement)	OCU support vehicle	ALL
	OCU support vehicle (idle)	OCU support vehicle	ALL

Table 3

Number of Task and Skill Incompatibilities

Total operation and maintenance tasks:	234
Total operations tasks	209
Total unit maintenance tasks	25
Total operations task and skill mismatches:	82
Skill mismatches (reason a):	
Skill level 20 or 30 required:	10
MOS-related mismatch	5
System-specific skills (reason b):	
Sarge mission planner specific:	9
TUV system specific:	33
Reasons a and b:	25
Unit maintenance task and skill mismatches:	25

RECOMMENDATIONS

There are three distinct possibilities for improving these skill mismatches:

1. The future TUV operator interface should be designed to accommodate skill level 10 capabilities for all tasks through the use of sound human factors engineering design or when possible and feasible, to re-allocate certain tasks to be automated, eliminating the skill incompatibility altogether. There are design possibilities to either alleviate the more difficult tasks or to aid the soldier-marine with automated functions so that the soldier-marine with the least experience may still teleoperate and perform the TUV mission successfully.

2. Train skill level 10 soldiers-marines to skill level 20 for those tasks identified with additional system-specific task training. This would require that skill level 10 soldiers-marines be trained in the interpretation and application of an operations order to TUV system operations and capabilities.

3. Alter the skill level 10 requirement for TUV operation to that of skill level 20, with training for system-specific tasks only. The other possibility is changing the criteria for basic TUV operations, to raise the minimum skill level from 10 to 20 or 30, to allow for those skills that are trained and more fully developed in the soldier-marine of more experience.

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APPENDIX A

U.S. ARMY AND U.S. MARINE CORPS OPERATIONS
AND UNIT MAINTENANCE TASKS

U.S. ARMY AND U.S. MARINE CORPS OPERATIONS AND UNIT MAINTENANCE TASKS

U.S. Army

STP 21-1-SMCT, Soldier's Manual of Common Tasks, Skill Level 1

071-329-1001 - Identify terrain features on a map. Identify major terrain features: hill, ridge, valley, saddle, and depression. Identify minor terrain features: draw, spur, cliff

071-329-1002 - Determine the grid coordinates of a point on a military map using the military grid reference system: Determine the six-digit grid coordinates for a point on a map with a 100 meter tolerance (grid coordinates must contain the correct two-letter 100,000-meter-square identifier. Determine the eight-digit grid coordinates for a point on a map with a 50 meter tolerance (grid coordinates must contain the correct two-letter 100,000-meter-square identifier.

071-329-1003 - Determine a magnetic azimuth using a compass: Determine the correct magnetic azimuth to a designated point, within 3 degrees using the compass-to-cheek method or within 10 degrees using the centerhold method.

071-329-1018 - Determine direction using field-expedient methods: Determine direction using the three field-expedient methods: stick or branch and two stones or a wrist watch, or at night given a clear view of the big dipper.

071-329-1012 - Orient a map to the ground by map-terrain association: Orient a map to North within 30 degrees.

071-329-1005 - Determine a location on the ground by terrain association: Determine the six-digit coordinates of your location to within 100 meters.

071-329-1008 - Measure distance on a map. Determine the straight line distance, in meters, between two points to within 100 meters. Determine the road (curved-line) distance, in meters, between two points to within 200 meters.

071-329-1006 - Navigate from one point on the ground to another point, dismounted: Move on foot to designated points at a rate of 3,000 meters in an hour.

071-331-0803 - Collect/Report Information- SALUTE - Make a complete and accurate oral or written report to your leader that describes each point of interest expressed by the letters of the key word SALUTE (size, activity, location, unit, time, equipment).

878-920-1001 - Recognize Friendly and Threat Armored Vehicles - Recognize 8 out of 10 vehicles as friendly or as a threat.

071-326-0512 - Estimate Range - State the actual range to each target with no more than 20% error (plus or minus).

441-091-1101 - Perform Search and Scan Procedures - Estimate 20% upper search limits. Perform two search and scan techniques.

113-571-1016 - Send a Radio Message - Send a voice radio message using correct radio procedures, correct prowords, correct phonetic alphabet and numbers.

071-326-0513 - Select Temporary Fighting Positions - Select and occupy a good fighting position that allows good observation, fields of fire, and provides in order of priority: cover and concealment, cover only, concealment only.

051-191-1361 - Camouflage Yourself and Your Individual Equipment - Camouflage all exposed skin areas and individual equipment to avoid detection.

051-191-1362 - Camouflage Equipment - Camouflage equipment to avoid detection.

051-191-1363 - Camouflage Your Defensive Position - Camouflage your position so that it cannot be detected from 35 meters forward.

071-331-0815 - Conduct Noise, Light, and Litter Discipline - Ensure that: 1. Noise is kept at a minimum. 2. No light is visible to the enemy. 3. The area is free of litter and other evidence of the unit's presence.

071-331-0801 - Use Challenge and Password - Detect and halt personnel in your sector. Challenge them using the correct challenge. If given correct password, allow personnel to pass. If not given correct password, attempt to detain (capture) personnel.

031-503-1002 - Put On, Wear, and remove your M-17 Series Protective Mask with Hood - Given an M-17-series mask with hood and the following situations: 1. Hear or see a chemical/biological alarm or, 2. Realize otherwise that you are under a chemical or biological attack, or 3. Are ordered to mask, or 4. After masking, given the all clear order.

031-503-1012 - Put On, Wear, and remove your M24, M25, or M25A1 Protective Mask with Hood - Given an M24, M25, or M25A1 mask with hood and the following situations: 1. Hear or see a chemical/biological alarm or, 2. Realize otherwise that you are under a chemical or biological attack, or 3. Are ordered to mask, or 4. After masking, given the all clear order.

031-503-1019 - Recognize and React to a Chemical or a Biological Hazard - 1. Put on assigned mask with hood. 2. Give the alarm. 3. Report the presence of a contamination marker to your supervisor. 4. Put on additional MOPP gear to reach MOPP IV.

031-503-1018 - Recognize and React to a Nuclear Hazard - 1. React to a nuclear attack with no warning (a brilliant flash of light). 2. React to a nuclear attack with warning. 3. Recognize radiological contamination markers and notify your supervisor.

AR 611-201, Jun 1991

Military Occupational Specialty (MOS) 19D, Cavalry Scout

- 10 - Locates points on a map, distinguishes topographic features, and uses compass
- 10 - Uses maps, map symbols and overlays
- 10 - Navigates on ground from point to point.
- 10 - Uses RADIAC instruments and chemical detection kits.
- 10 - Performs duties as crew member on Armored Airborne Reconnaissance Vehicle (AARV) M551 and scout vehicles.
- 10 - Serves as crew member of observation/listening post.
- 10 - Gathers and reports information on terrain feature and enemy strength, disposition, and equipment.
- 10 - Conducts route, fording and bridge reconnaissance.
- 10 - Identifies targets.
- 10 - Requests and adjusts indirect and aerial fire.
- 10 - Performs operator maintenance on scout vehicles, Sheridan tank (M551) crew-served weapons, and communications equipment.
- 10 - Assists in camouflage, cover and concealment of equipment and positions
- 10 - Operates wheeled and tracked scout vehicles and operates communication equipment.
- 10 - Operates M551 Sheridan tank.
- 10 - Uses radio-telephone procedures.
- 10 - Operates other wheeled and tracked vehicles in armor units as designated (wheels, carriers).
- 20 - Prepares, files, and distributes maps and overlays.

- 20 - Supervises operator maintenance of scout vehicles, Sheridan M551, individual and crew-served weapons.
- 30 - Evaluates routes, assembly area, and positioning for mounted combat operations.
- 30 - Supervises maintenance of assigned vehicles and equipment.
- 40 - Supervises platoon maintenance activities.

Military Occupational Specialty (MOS) 11B, Infantryman

- 10 - Performs preventative maintenance and assists in organizational maintenance on weapons and equipment.
- 10 - Performs basic communications functions and operates platoon communication equipment.
- 10 - Employs cover, concealment, and camouflage.
- 10 - Performs land navigation functions by terrain association.
- 10 - Requests indirect and aerial fire support.
- 10 - Reacts to oral commands and signals.
- 10 - Collects and reports intelligence and tactical information as a member of either a scout, combat, or a reconnaissance patrol.
- 10 - Operates track vehicles over varied terrain in varied visibility and weather conditions using techniques of movement commensurate with the threat.
- 10 - Reacts to audio and visual signals.
- 10 - Assists in refueling and vehicle operations.
- 10 - Conducts preventative and maintenance checks and services (PMCS) on organizational equipment.
- 10 - Operates wheeled and tracked truck to transport personnel, supplies, and equipment.
- 10 - Performs and assists in unit and organizational maintenance.
- 10 - Performs duties as guard.
- 10 - Delivers messages and performs other elementary tasks in support of operations and intelligence functions.
- 20 - Evaluates terrain and weapon emplacements.
- 20 - Sites and assigns target areas and fields of fire.
- 20 - Records operational information on maps.
- 20 - Indicates location, strength, tactical deployment and emplacement of enemy and friendly units.
- 20 - Reads and interprets maps and aerial photos, reproduces, distributes and files operations, intelligence, administrative and unit training documents, orders and publications.
- 20 - Receives and implements combat orders; directs deployment of personnel in offensive, defensive and retrograde combat operations.
- 20 - Supervises subordinate personnel in all phases of vehicle operation, operator maintenance, and tactical and administrative duties.
- 30 - Ensures collection and proper reporting of intelligence data to unit and other responsible staff sections.
- 50 - Plans, coordinates, supervises, and participates in activities pertaining to organization, training and combat operations and intelligence, of units at battalion or higher level.

U.S. Marine Corps Navigation Tasks Identified:

Marine Battle Skills Training (MBST) Handbook, Book 2 PVT-LCPL, Individual Combat Basic Tasks, January 1993

- PVTX.14.7 - Camouflage Self and Individual Equipment.
- PVTX.14.13 - Report Intelligence Information.
- PVTX.16.1 - Identify NATO NBC Markers.
- PVTX.16.3 - Don the M17 Series Field Protective mask with Hood.
- PVTX.16.8 - Identify Chemical Agents.
- PVTX.16.12 - React to Nuclear Attack.
- PVTX.16.13 - React to Chemical or Biological Attack.
- PVTX.16.14 - React to Nuclear Attack.
- PVTX.19.2 - Operate the TA-312 Telephone Set.
- PVTX.19.3 - Operate a TA-1 Telephone Set.
- PVTX.19.4 - Operate an AN/PRC-77 Field Radio Set.
- PVTX.18.1 - Perform Basic Map Reading.
- PVTX.18.2 - Navigate With a Map Using Terrain .
- PVTX.18.3 - Navigate With a Map Using a Compass.
- CPLX.12.4 - Determine Range.
- CPLX.14.1 - Enforce Camouflage, Cover, and Concealment.
- CPLX.14.2 - Enforce Light Discipline.
- CPLX.14.3 - Enforce Noise Discipline.
- CPLX.14.7 - Prepare a Terrain Model.
- CPLX.16.1 - Prepare NBC 1 Report (observer's report).
- CPLX.18.1 - Orient a Map Using Field Expedient Techniques.
- CPLX.18.2 - Locate an Unknown Point Using Resection.
- CPLX.18.3 - Locate an Unknown Point By Intersection.
- CPLX.18.4 - Determine Cardinal Directions by Field Expedient Methods.
- CPLX.18.5 - Navigate Around an Obstacle Using the Box Method.
- CPLX.18.6 - Convert Azimuths.
- CPLX.18.7 - Navigate by Dead Reckoning.
- CPLX.18.8 - Determine the Magnetic Azimuth to a Distant Point.
- CPLX.18.9 - Determine the Elevation of a Point Using a Map.
- CPLX.19.1 - Operate the AN/PRC-68A/KYV-2 Radio Set.
- CPLX.19.3 - Enter a Radio Telephone Net.
- CPLX.19.4 - Maintain Communications Security by Using the Numeral Cipher/Authentication System.
- SGTX.13.8 - Prepare Patrol Routes.
- SGTX.14.10 - Adjust Indirect Fire.
- SGTX.14.19 - Submit a Spot Report.
- SGTX.16.1 - Prepare a NBC 4 Report (Reconnaissance, Monitoring, and Survey Results).
- SGTX.18.1 - Navigate During the Day Using Intermediate Techniques.
- SGTX.18.2 - Navigate During the Night Using Intermediate Techniques.
- SGTX.19.4 - Supervise Operator Level Maintenance of Portable Communications Equipment.

MCO 1510.35C, Individual Training Standards for the Infantry (Enlisted)
Occupational Field (OCCFLD) 03

Military Occupational Specialty (MOS) 0300, Common Infantryman

- Task 0300.1.2 - Identify enemy and friendly equipment.
- Task 0300.1.14 - Adjust indirect fire.
- Task 0300.1.15 - Prepare an operation overlay.
- Task 0300.3.1 - Maintain radio sets.
- Task 0300.3.3 - Communicate using the AN/PRC-119 SINCGARS radio.
- Task 0300.4.1 - Determine the location of a point or object by intersection.
- Task 0300.4.2 - Determine the location of a point or object by resection.
- Task 0300.4.3 - Select routes using a map.
- Task 0300.6.1 - Maintain the HMMWV.
- Task 0300.6.2 - Prepare a HMMWV for operations.
- Task 0300.6.3 - Operate a HMMWV.
- Task 0300.6.4 - Camouflage a tactical vehicle.
- Task 0300.6.7 - Direct a driver over a terrain route.

Military Occupational Specialty (MOS) 0311, Rifleman

- Task 0311.5.1 - Execute a daylight scouting mission.
- Task 0311.5.2 - Execute a night scouting mission.
- Task 0311.6.1 - Operate an AN/PRC-104 radio set.
- Task 0311.6.2 - Operate an AN/PRC-113 radio set.
- Task 0311.6.9 - Navigate using a Global Positioning System (GPS).
- Task 0311.6.10 - Execute surveillance of an objective.
- Task 0311.6.13 - Collect data for the classification of a route.
- Task 0311.6.14 - Establish an observation post.
- Task 0311.6.15 - Photograph an objective.
- Task 0311.6.16 - Conduct a road reconnaissance.
- Task 0311.6.17 - Conduct a bridge reconnaissance.
- Task 0311.6.18 - Conduct a tunnel reconnaissance.
- Task 0311.6.19 - Conduct a water crossing reconnaissance.

APPENDIX B

TUV OPERATIONS AND UNIT MAINTENANCE TASKS

FUNCTIONS

TASKS

Top Mid Low Task

7.4 Mission Planning

7.4.1 Receive Orders

7.4.1.1 Receive Orders from Battalion

7.4.1.2 Acknowledge Receipt of Orders

7.4.2 Conduct Battle Drills

7.4.2.1 Conduct Battle Drills

7.4.3 Develop RS/NBC Survey Plan

7.4.3.1 Select Final RSTA Point(s)

7.4.3.1.1 Assess Named Areas of Interest (NAI) from OpOrders

7.4.3.1.2 Place MBU Icon in Final RSTA Area of OCU Map Displ

7.4.3.1.3 Does MBU LOS & Range Fan Cover NAI?

7.4.3.1.6 Reposition MBU to Modify LOS and Range Fan Coverag

7.4.3.1.7 Final RSTA Position Established

7.4.3.2.1 Is Fibre Optic Only A Mission Requirement?

7.4.3.2.4 Place OCU Icon on OCU Map Display

7.4.3.2.5 Concealment OK for LOS RF?

7.4.3.2.6 Is Distance to MBU OK for LOS RF?

7.4.3.2.7 Is Terrain OK for LOS RF?

7.4.3.2.8 Is Enemy Situation OK for LOS RF?

7.4.3.2.9 Is Friendly Situation OK for LOS RF?

7.4.3.2.14 Is Concealment OK for Fibre Optic?

7.4.3.2.15 Is Distance to MBU OK for Fibre Optic?

7.4.3.2.16 Is Terrain OK for Fibre Optic?

7.4.3.2.17 Is Enemy Situation OK for Fibre Optic?

7.4.3.2.18 Is Friendly Situation OK for Fibre Optic?

7.4.3.2.24 Re-evaluate Position and Try Again

7.4.3.2.21 RF Position Established

7.4.3.2.22 Fibre Optic Position Established

7.4.3.2.23 Final Teleoperation Point Established

7.4.3.2.12 OCU Fibre Optic Positioning

7.4.3.2 Determine Final Teleoperation Point

7.4.3.2.1 Is Fibre Optic Only A Mission Requirement?

7.4.3.2.2 Yes

7.4.3.2.3 No

7.4.3.2.4 Place OCU Icon on OCU Map Display

7.4.3.2.5 Concealment OK for LOS RF?

7.4.3.2.6 Is Distance to MBU OK for LOS RF?

7.4.3.2.7 Is Terrain OK for LOS RF?

7.4.3.2.8 Is Enemy Situation OK for LOS RF?

Skill 10 Capable?

Yes

F1

F2

F3

F3

F2

F3

F2

F3

Type of Skill Mismatch

No

F1

F2

F3

F3

F2

F3

F2

F3

Skill 20

Skill 30, SARGE M.P. Specific Tasks

Skill 30, SARGE M.P. Specific Tasks

Skill 30, SARGE M.P. Specific Tasks

n/a

Skill 20

SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

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Skill 20, SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

n/a

n/a

n/a

n/a

n/a

F3

Skill 20

X

n/a

n/a

SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

FUNCTIONS

Top Mid Low

TASKS

Task

Skill 10 Capable?

Yes

No

Type of Skill Mismatch

Skill 20, SARGE M.P. Specific Tasks

Skill 20, SARGE M.P. Specific Tasks

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Skill 20, SARGE M.P. Specific Tasks

FUNCTIONS	TASKS	Skill 10 Capable?		Type of Skill Mismatch
		Yes	No	
Top	Mid	Low	Task	
	7.4.3.6.6	Evaluate Terrain	X	
	7.4.3.6.7	Evaluate Natural and Intentional Obstacles	X	
	7.4.3.6.8	Evaluate Terrain Elevations & Slopes	X	
	7.4.3.6.9	Evaluate Possible Roads, Paths & Trails	X	
	7.4.3.6.10	Evaluate Ground Surface (Dirt, Mud, Grass, Snow,	X	
	7.4.3.6.11	Evaluate Foliage (LOS & RF Distances per leg)	X	Skill 20, SARGE M.P. Specific Tasks
	7.4.3.6.12	Terrain Evaluated	n/a	
	7.4.3.6.13	METT Evaluated	n/a	
	7.4.3.6.14	Estimate Average Speed Over Route	X	SARGE M.P. Specific Tasks
	7.4.3.6.15	Travel Time Estimate Complete	X	
	7.4.3.7	Deliver Brief Back	F3	
	7.4.3.7.1	Collect Coordinated Mission Plans from Sections	F3	
	7.4.3.7.2	Send Platoon Mission Plan to Battalion	X	Skill 20
	7.4.4	Perform Mission Rehearsals	X	Skill 20
	7.4.4.1	Perform Mission Rehearsals	F3	
	7.4.5	Prepare for Transport	F3	
	7.4.5.1	Prepare System for Transport	F2	
	7.4.6	Final Checks	F3	
	7.4.6.1	RS/NBC Survey Plan Completed?	F2	
	7.4.6.2	Mission Payload Correctly Configured for Mission?	X	
	7.4.6.3	System Ready for Transport?	X	
	7.4.6.4	Yes	X	
	7.4.6.5	Yes	n/a	
	7.4.6.6	Yes	n/a	
	7.4.6.7	No	n/a	
	7.4.6.8	No	n/a	
	7.4.6.9	No	n/a	
	7.4.6.10	Re-do Missing Element(s)	n/a	
	7.4.7	Assemble Mission Payload	X	
	7.4.7.2	A Rangefinder?	F2	
	7.4.7.7	Yes	X	
	7.4.7.8	No	n/a	
	7.4.7.9	Mission Package Have the Unit?	n/a	
	7.4.7.10	Yes	X	
	7.4.7.11	No	n/a	
	7.4.7.12	Leave Unit On Mission Package	n/a	
	7.4.7.13	Put Unit on Mission Package	X	
	7.4.7.23	Rangefinder Done	n/a	
	7.4.7.14	Mission Package Have the Unit?	X	TUV Operation Specific Task

FUNCTIONS TASKS

Top Mid Low Task

7.4.7.15 Yes

7.4.7.16 No

7.4.6.17 Remove Unit

7.4.7.24 NBC Detection Device Done

7.4.7.25 Day Cameras Done

7.4.7.27 Acoustic Package Done

7.4.7.1 Does the Mission Package Require...

7.4.7.26 Night Camera(s) Done

7.4.7.3 An NBC Detection Package?

7.4.7.4 Day Camera(s)?

7.4.7.5 Night Camera(s)?

7.4.7.6 An Acoustic Sensor Package?

7.4.7.28 Mission Package Assembled

7.4.7.18 Leave Unit Off Mission Package

7.4.7.19 Unit Added or Removed?

7.4.7.20 Yes

7.4.7.21 No

7.4.7.22 Add Unit Work Time

7.5 Conduct Mission

7.5.1 Move

7.5.1.1 Airdrop

7.5.1.1.1 Rig For Airdrop

7.5.1.1.2 LVAD capable

7.5.1.1.3 Pack Energy Dissipating Material for LVAD

7.5.1.1.4 Provide Secure Points for LVAD Platform

7.5.1.1.5 Allow Malfunction Condition Drops

7.5.1.1.6 Load on Transport

7.5.1.1.7 Transport to Drop Point

7.5.1.1.8 Execute Airdrop

7.5.1.1.9 De-rig/Assemble

7.5.1.2 Air Assault

7.5.1.2.1 Rig for Air Assault

7.5.1.2.2 Load on Transport

7.5.1.2.3 Transport

7.5.1.2.4 Air Insertion

7.5.1.2.5 De-rig/Assemble

7.5.1.3 Roll-on/Roll-off

7.5.1.3.1 Rig

7.5.1.3.2 Load on Transport

Skill 10 Capable?

Yes No Type of Skill Mismatch

n/a

n/a

X

TUV Operation Specific Task

n/a

n/a

n/a

X

Skill 20

n/a

X

X

X

X

n/a

X

X

n/a

n/a

n/a

F1

F2

F3

F1

F2

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TUV Operation Specific Task

FUNCTIONS	TASKS		Skill 10 Capable?		Type of Skill Mismatch
	Top Mid	Low Task	Yes	No	
		7.5.1.3.3 Transport		X	TUV Operation Specific Task
		7.5.1.3.4 Off-load		X	TUV Operation Specific Task
		7.5.1.3.5 De-rig/Assemble		X	TUV Operation Specific Task
	7.5.1.4	Amphibious Assault			
		7.5.1.4.1 Rig (amphibious)	F3	F3	
		7.5.1.4.2 Load		X	TUV Operation Specific Task
		7.5.1.4.3 Load on Amphibious Ship		X	TUV Operation Specific Task
		7.5.1.4.4 Load on Amphibious Landing Craft		X	TUV Operation Specific Task
		7.5.1.4.5 Transport		X	TUV Operation Specific Task
		7.5.1.4.6 Off-load (amphibious)		X	TUV Operation Specific Task
		7.5.1.4.7 De-rig/Assemble		X	TUV Operation Specific Task
	7.5.1.5	Transport (tow, carry, drive) to Teleop Point		X	TUV Operation Specific Task
		7.5.1.5.1 Provide Own Power	F3	X	TUV Operation Specific Task
		7.5.1.5.2 Provide Transport by HMMWV	X		
	7.5.2	System Set-up			
		7.5.2.1 Prepare MBU			
		7.5.2.1.1 Power Up MBU Main Switch	F2	F2	
		7.5.2.1.2 BIT/BITE Test OK?	F3	F3	
		7.5.2.1.3 Yes	X		
		7.5.2.1.4 No	n/a		
		7.5.2.1.5 Check Status of Driving Cameras	n/a		
		7.5.2.1.6 Check All MBU Status Functions	X		
		7.5.2.1.7 Power Down for Another System Check	X		
	7.5.2.2	Ground Mount OCU	F3	F3	
		7.5.2.2.1 Remove OCU from Carrier	X		
		7.5.2.2.2 Carry OCU to Desired Location	X		
		7.5.2.2.3 Set OCU on Ground	X		
		7.5.2.2.4 Open OCU for Use	X		
	7.5.2.3	Prepare OCU	F3	F3	
		7.5.2.3.1 Camouflage OCU	X		
		7.5.2.3.2 Power Up OCU	X		
		7.5.2.3.3 Check BIT/BITE Status	X		
		7.5.2.3.4 BIT/BITE OK?	X		
		7.5.2.3.5 Yes	n/a		
		7.5.2.3.6 No	n/a		
		7.5.2.3.7 Power Down for Another Check	X		
		7.5.2.3.9 OCU Preparation Complete	n/a		
		7.5.2.3.8 Check Battery Level	X		
	7.5.2.4	Prepare Mission Payload	F3	F3	

FUNCTIONS Top Mid Low	TASKS Task	Skill 10 Capable?		Type of Skill Mismatch
		Yes	No	
	7.5.2.4.1 Power Up Payload Suite	X		
	7.5.2.4.2 Check BIT/BITE Status of Each Payload Module	X		
	7.5.2.4.3 BIT/BITE Status OK?	X		
	7.5.2.4.4 Yes	n/a		
	7.5.2.4.5 No	n/a		
	7.5.2.4.6 Power Down for Another Check	X		
	7.5.2.4.7 Payload Prepared	n/a		
	7.5.2.5 Pre-Operation/PMCS Checks	F3	F3	
	7.5.2.5.1 Check MBU	n/a		
	7.5.2.5.2 Check MBU Fuel Level	X		
	7.5.2.5.3 Check MBU Battery Level	X		
	7.5.2.5.4 Check MBU Oil Level	X		
	7.5.2.5.5 Check MBU Tire Pressure	X		
	7.5.2.5.6 Check MBU Hydraulic Fluid	X		
	7.5.2.5.7 Check RSTA/NBC Package	n/a		
	7.5.2.5.8 Check Day Camera Operation	X		
	7.5.2.5.9 Check Night Camera Operation	X		
	7.5.2.5.10 Check Acoustic Package Operation	X		
	7.5.2.5.11 Check Range Finder Operation	X		
	7.5.2.5.12 Check NBC System Operation	X		
	7.5.2.5.13 Check OCU	n/a		
	7.5.2.5.14 Check Data Link Steering	X		
	7.5.2.5.15 Check Data Link Throttle	X		
	7.5.2.5.16 Check Data Link Brake	X		
	7.5.2.5.17 Check OCU Map Display	X		
	7.5.2.5.18 Check Data Link GPS/UTM Reference System	X		
	7.5.2.5.19 Check Voice Radio System	X		
	7.5.2.5.21 Pre-operation & PMCS Complete	n/a		
7.5.3 Unmanned Operation				
	7.5.3.1 Teleoperate to AO (and Moving NBC Detection)	F2	F2	
	7.5.3.1.1 Teleoperate to AO (Moving NBC Detection)	F3	F3	
	7.5.3.1.2 Navigate	n/a		
	7.5.3.1.3 Visually on Course (terrain navigation)?	n/a		
	7.5.3.1.6 Yes	X		
	7.5.3.1.8 Hold Course	n/a		
	7.5.3.1.11 dummy3	X		
	7.5.3.1.12 dummy4	n/a		
	7.5.3.1.13 Communicate/Report System Status	n/a		
	7.5.3.1.4 Navigation Position Correct (GPS/UTM/Waypoint)?	X		
		X		

FUNCTIONS	TASKS	Skill 10 Capable?		Type of Skill Mismatch
		Yes	No	
Top Mid	Low			
	7.5.3.1.9 Steer Left	X		
	7.5.3.1.10 Steer Right	X		
	7.5.3.1.7 No	n/a		
	7.5.3.1.5 Immediate Path Obstacle-Free?	X		
	7.5.3.1.11 Stop MBU	X		
	7.5.3.1.12 Reverse Until Obstacle Passable	X		
	7.5.3.1.14 Power Vehicle	X		
	7.5.3.1.15 Too Fast?	X		
	7.3.5.1.17 Yes	n/a		
	7.3.5.1.18 Decrease Throttle	X		
	7.5.3.1.21 dummy2	n/a		
	7.5.3.1.19 Increase Brake	X		
	7.5.3.1.20 Hold Brake	X		
	7.5.3.1.18 No	n/a		
	7.5.3.1.22 Too Slow?	X		
	7.5.3.1.23 Yes	n/a		
	7.5.3.1.25 Increase Throttle	X		
	7.5.3.1.28 dummy1	n/a		
	7.5.3.1.24 No	n/a		
	7.5.3.1.26 Decrease Throttle	X		
	7.5.3.1.27 Hold Throttle	X		
	7.5.3.1.29 Conduct NBC Monitoring	n/a		
	7.5.3.1.30 Detect NBC Contaminants?	X		
	7.5.3.1.31 Yes	n/a		
	7.5.3.1.33 Report NBC Information	X		
	7.5.3.1.32 No	n/a		
	7.5.3.1.34 Monitor Vehicle Status	X		
	7.5.3.1.35 Monitor Fuel Level	X		
	7.5.3.1.36 Monitor MBU/OCU Battery Levels	X		
	7.5.3.1.37 Monitor Distance Traveled	X		
	7.5.3.1.38 Monitor Date	X		
	7.5.3.1.39 Monitor Time	X		
	7.5.3.1.40 dummy5	n/a		
	7.5.3.1.41 Monitor Vehicle Orientation	X		
	7.5.3.1.42 Monitor Vehicle Pitch Angle	X		
	7.5.3.1.43 Monitor Vehicle Roll Angle	X		
	7.5.3.1.44 Pitch and Roll Angles Acceptable?	X		
	7.5.3.1.45 Yes	n/a		
	7.5.3.1.46 No	n/a		

FUNCTIONS	TASKS	Skill 10 Capable?		Type of Skill Mismatch
		Yes	No	
Top Mid	Low			
	7.5.3.1.51 Hold Course	X		
	7.5.3.1.47 Steer Right	X		
	7.5.3.1.48 Steer Left	X		
	7.5.3.1.49 Stop MBU	X		
	7.5.3.1.50 Reverse Until Pitch and Roll is Acceptable	X		
	7.5.3.1.52 dummy7	n/a		
	7.5.3.3 RSTA Mission	F3	F3	
	7.5.3.3.1 RSTA Mission (dummy)	n/a		
	7.5.3.3.2 Power Up all RSTA Systems	X		
	7.5.3.3.4 Select Day RSTA Camera	X		
	7.5.3.3.5 Night RSTA Camera	X		
	7.5.3.3.3 Visual RSTA Systems	X		
	7.5.3.3.6 Scan Horizontally	X		
	7.5.3.3.7 Tilt RSTA Camera to Change Elevation	X		
	7.5.3.3.8 Detect Target?	X		
	7.5.3.3.9 Yes	n/a		
	7.5.3.3.10 No	n/a		
	7.5.3.3.11 Need Wider or Tighter View?	X		
	7.5.3.3.12 Yes	n/a		
	7.5.3.3.13 No	n/a		
	7.5.3.3.14 Zoom In/Zoom Out	X		
	7.5.3.3.15 Need Clearer Image?	X		
	7.5.3.3.16 Yes	n/a		
	7.5.3.3.17 No	n/a		
	7.5.3.3.18 Focus Near/Far	X		
	7.5.3.3.19 Identify Target?	X		
	7.5.3.3.20 Yes	n/a		
	7.5.3.3.21 No	n/a		
	7.5.3.3.22 Communicate/Report Target Contact	X		
	7.5.3.3.23 Range Target	X		
	7.5.3.3.24 Put Targeting Reticle on Target	X		
	7.5.3.3.25 Activate Rangefinder	X		
	7.5.3.3.26 Verify Position of Target Data	X		
	7.5.3.3.27 Transmit Still Image w/GPS/UTM Position Info	X		
	7.5.3.3.28 Call for Fire Needed?	X		
	7.5.3.3.29 Yes	n/a		
	7.5.3.3.30 No	n/a		
	7.5.3.3.31 Initiate Call for Fire	X		
	7.5.3.3.32 Mission Complete?	X		

FUNCTIONS	TASKS	Skill 10 Capable?		Type of Skill Mismatch
		Yes	No	
Top Mid	Low Task			
	7.5.3.3.35 Mission Completed	n/a		
	7.5.3.3.33 Yes	n/a		
	7.5.3.3.34 No	n/a		
	7.5.3.3.35 Acoustic System	X		
	7.5.3.3.36 Detect Target?	X		
	7.5.3.3.37 Yes	n/a		
	7.5.3.3.38 No	n/a		
	7.5.3.3.39 Determine Azimuth to Target	X		
	7.5.3.3.40 Orient Acoustics to Sound Source	X		
	7.5.3.4 NBC Survey Mission	F3	F3	
	7.5.3.4.1 NBC Survey Mission (dummy)	n/a		
	7.5.3.4.2 Passive Search	n/a		
	7.5.3.4.3 Detect NBC Agents?	X		
	7.5.3.4.4 Yes	n/a		
	7.5.3.4.5 No	n/a		
	7.5.3.4.6 Classify Contaminant	X,		No Training, 11B
	7.5.3.4.7 Nuclear Contaminant	X		No Training, 11B
	7.5.3.4.8 Biological Contaminant	X		No Training, 11B
	7.5.3.4.9 Chemical Contaminant	X		No Training, 11B
	7.5.3.4.10 Report NBC Information	X		No Training, 11B, USMC CPL
	7.5.3.4.10 Active Search	X		
	7.5.3.4.12 Mission Complete?	n/a		
	7.5.3.4.12 Visual Search	X		
	7.5.3.4.13 Scan Horizontally for Round Bursts	n/a		
	7.5.3.4.14 Tilt Camera to Change Elevation	X		
	7.5.3.4.15 Detect Round Burst or Cloud?	X		
	7.5.3.4.16 Yes	n/a		
	7.5.3.4.17 No	n/a		
	7.5.3.4.18 Note Direction of Burst, Size, Direction of Attac	X		
	7.5.3.4.19 Yes	n/a		
	7.5.3.4.20 No	n/a		
	7.5.3.4.22 RSTA Mission Complete	n/a		
	7.5.3.5 Teleoperate Back to OCU	F3	F3	
	7.5.3.6 Drive Forward to MBU	F3	F3	
	7.5.3.7 Mission Complete (dummy)	F3	F3	
	7.5.4 System Shutdown	F2	F2	
	7.5.4.1 Post Operation Checks/PMCS	F3	F3	
	7.5.4.1.1 All Systems Functional?	X		
	7.5.4.1.2 Yes	n/a		

<u>FUNCTIONS</u> Top Mid Low	<u>TASKS</u> Task	<u>Skill 10 Capable?</u>		<u>Type of Skill Mismatch</u>
		Yes	No	
	7.5.4.1.3 No	n/a		
	7.5.4.1.4 Repair as Needed		X	TUV Maintenance Specific Task
	7.5.4.1.5 Add Fuel to MBU	X		
	7.5.4.1.6 Add Oil to MBU	X		
	7.5.4.1.7 Charge MBU Batteries		X	TUV Operation Specific Task
	7.5.4.1.8 Charge OCU Batteries		X	TUV Operation Specific Task
	7.5.4.2 Stow OCU	F3	F3	
	7.5.4.2.1 Stow OCU for Transport		X	TUV Operation Specific Task
	7.5.4.2.2 Pack Camouflage Netting	X		
	7.5.4.3 Rig MBU for Travel/Transport	F3	F3	
	7.5.4.3.1 Rig MBU for Travel/Transport		X	TUV Operation Specific Task
7.6 Post-Mission Activities		F1	F1	

Note: n/a denotes that the task or function is not applicable, regardless of MOS identified, an "X" in the Yes/No column denotes that the task can/cannot be performed by a skill level 10 soldier.

F1= Function, top level, F2=function, mid-level, F3=function, low level.

<u>Maintenance Data</u> Subsystem	Component	<u>Skill 10 Capable?</u>		Unit	Unsched.	Remove & Replace	Type of Skill Mismatch
		Yes	No				
RCMMS (teleoperation)	Platform (teleoperation)			Unit	Unsched.	Remove & Replace	
	System Power			Unit	Unsched.	Remove & Replace	
	MBU Actuation Package			Unit	Unsched.	Remove & Replace	
	Control Electronics			Unit	Unsched.	Remove & Replace	
	Driving Sensor			Unit	Unsched.	Remove & Replace	
RCMMS (recharge)	Platform (recharge)			Unit	Unsched.	Remove & Replace	
	System Power			Unit	Unsched.	Remove & Replace	
	Control Electronics			Unit	Unsched.	Remove & Replace	
Chemical/Biological Detection	Chemical Detection			Unit	Unsched.	Remove & Replace	
	Biological Detection			Unit	Unsched.	Remove & Replace	
Laser Range Finder	Laser Range Finder			Unit	Unsched.	Remove & Replace	
	Recon, Surveil, & Target Acquisition			Unit	Unsched.	Remove & Replace	
Targeting Sensor	Pan/Tilt			Unit	Unsched.	Remove & Replace	
	Control Electronics			Unit	Unsched.	Remove & Replace	
Acoustic Detection Syst	Acoustic Detection Syst			Unit	Unsched.	Remove & Replace	
	Motion Sensors			Unit	Unsched.	Remove & Replace	
Operator Control Unit	Operator Control Unit			Unit	Unsched.	Remove & Replace	
	Data Link			Unit	Unsched.	Remove & Replace	
Video Link	Video Transmission Unit			Unit	Unsched.	Remove & Replace	
	Video Link Radios			Unit	Unsched.	Remove & Replace	
Communications	Communications Equipr			Unit	Unsched.	Remove & Replace	
	Navigation Package			Unit	Unsched.	Remove & Replace	
Microphone	Microphone			Unit	Unsched.	Remove & Replace	
	OCU Support Vehicle (movement)			Unit	Unsched.	Remove & Replace	
OCU Support vehicle (idle)	OCU Support vehicle (idle)			Unit	Unsched.	Remove & Replace	
	OCU Support vehicle (ic Remove & Replace			Unit	Unsched.	Remove & Replace	

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13. ABSTRACT (Maximum 200 words) An analysis was performed to identify specific skills required to successfully perform operations and unit maintenance tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a skill level of 10 have those skills. This analysis was performed by the Human Research and Engineering Directorate of the U.S. Army Research Laboratory at the behest of the Program Manager Unmanned Ground Vehicles/Systems. Military occupational specialties examined included U.S. Army infantryman (11B), cavalry scout (19D), and the Marine Corps rifleman (0300). System-required operations and unit maintenance functions and tasks were identified. Soldier-marine operations and unit maintenance skills were compared to these tasks. Results of the analysis show that of 209 operations skills required by the TUV system, 82 were mismatched because of a higher skills requirement, untrained system-specific skills, or a combination of both. Additionally, all 25 unit maintenance tasks were identified as requiring system-specific training.					
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